What is claimed is:

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- 1 1. An active filter that can be connected to a power line between a power 2 source and a load, the active filter comprising:
- a current generator that can be connected to the power line, wherein in response to a control signal the current generator generates a current *i_{APF}* to compensate for polluting harmonics on the power line; and
- a controller that generates a control signal that controls the current generator to

 compensate for the polluting harmonics on the power line, such that the current *i_{APF}*does not exceed a selected threshold value.
- The active filter of claim 1, wherein the controller further includes a limiter that generates said control signal based on feedback values of the current i_{APF} and the current i_L flowing through the load, to control the current generator such that the current i_{APF} does not exceed the selected threshold value.
 - 3. The active filter of claim 2, further comprising:
- a first sensor that senses the current i_{APF} and provides a corresponding signal to the limiter that represents the feedback value for the current i_{APF} ; and
- a second sensor that senses the current i_L flowing through the load and provides a corresponding signal to the limiter that represents the feedback value for the current i_L .

- 1 4. The active filter of claim 2, wherein the limiter is configured to control the
- 2 current generator such that even if the current i_{APF} necessary to compensate for the
- 3 polluting harmonics on the power line exceeds said selected threshold value, the
- 4 current i_{APF} generated by the current generator is limited to at most the selected
- 5 threshold value.
- 1 5. The active filter of claim 2, wherein:
- 2 the power source comprises an input voltage source providing a voltage
- 3 v_s ; and

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- 4 the limiter generates the control signal such that the current i_{APF} is
- 5 controlled as:

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$$i_{APF} = \begin{cases} i_{L} - v_{S} / R_{EM} ; & |i_{L} - v_{S} / R_{EM}| < I_{\text{max}}, \\ I_{\text{max}}; & |i_{L} - v_{S} / R_{EM}| \ge I_{\text{max}}, \end{cases}$$

- 7 where $R_{\rm EM}$ represents the equivalent resistance seen by the input
- 8 voltage source $v_{\scriptscriptstyle S}$, and $I_{\scriptscriptstyle \rm max}$ represents said selected threshold value.
- 1 6. The active filter of claim 5, further comprising a reference current
- 2 generator that provides a reference current value to the controller, wherein the
- 3 reference current value represents the ratio value V_S/R_{EM} .
 - 7. The active filter of claim 6, wherein:

2 the current generator includes an energy storage device that sources or 3 sinks the current i_{APF} as necessary to compensate for polluting harmonics on the power 4 line, wherein the current i_{APF} does not exceed the selected threshold value; and 5 the reference current generator receives a voltage feedback value from 6 the current generator that represents the energy storage device voltage, and the 7 reference current generator determines the value R_{EM} based on the voltage feedback 8 value from the current generator, to achieve energy balance whereby the energy 9 storage device voltage does not exceed a selected limit. 1 8. The active filter of claim 1, wherein the current generator comprises: 2 an energy storage device; and 3 a switch controlled by the control signal from the controller, such that the 4 energy storage device sources or sinks the current i_{APF} as necessary to compensate for 5 polluting harmonics on the power line, wherein the current i_{APF} does not exceed a

9. The active filer of claim 8, wherein:

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selected threshold value.

the energy storage device includes a capacitor device; and

3 the current generator further includes an inductor, such that the capacitor

devices sources or sinks the current i_{APF} , through the inductor.

1	10. An active filter connected to a power line between a power source and a		
2	load to compensate for polluting harmonics on the power line, the active filter		
3	comprising:		
4	a current generator connected to the power line in a parallel circuit with the		
5	power source and the load, wherein in response to a control signal the current		
6	generator generates a current i_{APF} to compensate for polluting harmonics on the power		
7	line; and		
8	a current controller that controls the current generator to compensate for the		
9	polluting harmonics on the power line, the controller including:		
10	a first sensor that senses the current i_{APF} and provides a corresponding signal		
11	that represents a feedback value for the current i_{APF} ;		
12	a second sensor that senses the current i_L flowing through the load and provides		
13	a corresponding signal that represents the feedback value for the current i_L ; and		
14	a limiter that generates said control signal based on feedback values of the		
15	current i_{APF} and the current i_L , wherein the limiter is configured to control the current		
16	generator such that if the current i_{APF} necessary to compensate for the polluting		
17	harmonics on the power line exceeds a selected threshold value, the current i_{APF}		
18	generated by the current generator is limited to at most the selected threshold value.		
1	11. The active filter of claim 10, wherein:		
2	the power source comprises an input voltage source providing a voltage		

 $v_{\scriptscriptstyle S}$; and

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- 4 the limiter generates the control signal such that the current i_{APF} is
- 5 controlled as:

$$i_{APF} = \begin{cases} i_{L} - v_{S}/R_{EM} ; & |i_{L} - v_{S}/R_{EM}| < I_{max} \\ I_{max}; & |i_{L} - v_{S}/R_{EM}| \ge I_{max} \end{cases},$$

- 7 where R_{EM} represents the equivalent resistance seen by the input
- 8 voltage source $v_{\scriptscriptstyle S}$, and $I_{\scriptscriptstyle \rm max}$ represents said selected threshold value.
- 1 12. The active filter of claim 11, further comprising a reference current
- 2 generator that provides a reference current value to the controller, wherein the
- 3 reference current value represents the ratio value V_S/R_{EM} .
- 1 13. The active filter of claim 12, wherein:
- 2 the current generator includes an energy storage device that sources or
- 3 sinks the current i_{APF} as necessary to compensate for polluting harmonics on the power
- 4 line, wherein the current i_{APF} does not exceed the selected threshold value; and
- 5 the reference current generator receives a feedback value from the
- 6 current generator that represents the level of the energy stored in the energy storage
- 7 device, and the reference current generator determines the value R_{EM} based on the
- 8 feedback value from the current generator, to achieve energy balance whereby the
- 9 energy level of the energy storage device is maintained within predetermined limits.

The active filter of claim 13, wherein the current generator further 1 14. 2 comprises a switch controlled by the control signal from the controller, such that the energy storage device sources or sinks the current i_{APF} as necessary to compensate for 3 polluting harmonics on the power line, wherein the current i_{APF} does not exceed a 4 selected threshold value. 5 The active filer of claim 14, wherein: 1 15. the energy storage device includes a capacitor device; and 2 the current generator further includes an inductor, such that the capacitor 3 devices sources or sinks the current i_{APF} , through the inductor. 4 1 16. A method of filtering a power line having a power source and a load 2 connected thereto, comprising the steps of: providing a current generator that can be connected to the power line, wherein 3 the current generator generates a current i_{APF} to compensate for polluting harmonics on 4 5 the power line; and 6 controlling the current generator to compensate for the polluting harmonics on 7 the power line, such that the current i_{APF} does not exceed a selected threshold value. 1 17. The method of claim 16, wherein the steps of controlling the current 2 generator further includes the steps of controlling the current generator based on feedback values of the current i_{APF} and the current i_{L} flowing through the load, such that 3 4 the current i_{APF} does not exceed the selected threshold value.

- 1 18. The method of claim 17, wherein the steps of controlling the current
- 2 generator further includes the step of:
- 3 sensing the APF current i_{APF} with a first sensor that provides a
- 4 corresponding signal representing the feedback value for the current i_{APF} ; and
- sensing the load current i_L with a second sensor that provides a
- 6 corresponding signal representing the feedback value for the current i_L .
- 1 19. The method of claim 17, wherein the steps of controlling the current
- 2 generator further includes the step of:
- controlling the current generator such that even if the current i_{APF}
- 4 necessary to compensate for the polluting harmonics on the power line exceeds said
- 5 selected threshold value, the current i_{APF} generated by the current generator is limited
- 6 to at most the selected threshold value.
- 1 20. The method of claim 17, wherein:
- the power source comprises an input voltage source providing a voltage
- 3 v_s ; and
- 4 the current i_{APF} is controlled such that:

$$i_{APF} = \begin{cases} i_{L} - v_{S}/R_{EM} ; & |i_{L} - v_{S}/R_{EM}| < I_{\max} \\ I_{\max}; & |i_{L} - v_{S}/R_{EM}| \ge I_{\max} \end{cases},$$

- 6 where R_{EM} represents the equivalent resistance seen by the input
- 7 voltage source $v_{\rm S}$, and $I_{\rm max}$ represents said selected threshold value.

1	21.	The method of claim 20, further comprising the steps of determining a	
2	reference current value that represents the ratio value $V_{\mathcal{S}}$ / R_{EM} .		
1	22.	The method of claim 21, wherein:	
2		the current generator includes an energy storage device that sources or	
3	sinks the current i_{APF} as necessary to compensate for polluting harmonics on the power		
4	line, whereir	n the current i_{APF} does not exceed the selected threshold value; and	
5		the steps of determining a reference current value, further includes the	
6	steps of rec	eiving a voltage feedback value from the current generator that represents	
7	the energy storage device voltage, and determining the value $R_{\it EM}$ based on the voltage		
8	feedback value from the current generator, to achieve energy balance whereby the		
9	energy storage device voltage does not exceed a selected limit.		
1	23.	The method of claim 16, wherein the current generator comprises:	
2		an energy storage device; and	
3		a controllable switch, such that the energy storage device sources or sinks	
4	the current i_{APF} as necessary to compensate for polluting harmonics on the power line,		
5	wherein the current i_{APF} does not exceed a selected threshold value.		
1	24.	The method of claim 23, wherein:	
2		the energy storage device includes a capacitor device; and	
3		the current generator further includes an inductor, such that the capacitor	
4	devices sources or sinks the current i_{APF} , through the inductor.		

- 1 25. The method of claim 16, wherein the step of controlling the current
- 2 generator further includes controlling the current generator to compensate for the
- 3 polluting harmonics on the power line, such that the current i_{APF} is bounded by a
- 4 selected upper threshold and a selected lower threshold.